

We claim:

CLAIMS

1. A data storage apparatus comprising:
 - a read head for reading magnetic data from a recorded portion of a recording layer of a perpendicularly recorded magnetic medium;
 - a stabilizer for magnetically stabilizing a portion of an underlayer of the magnetic medium directly below the recorded portion simultaneously while the read head is reading said magnetic data from the recorded portion; and
 - the read head and the stabilizer being separate structures.
- 10 2. A data storage apparatus as claimed in claim 1 wherein the stabilizer includes:
 - first and second elongated probes and a bridge with the bridge interconnecting the first and second probes; and
 - 15 the read head being located between the first and second probes.
3. A data storage apparatus as claimed in claim 1 further comprising:
 - the read head having a head surface which defines a head surface plane;
 - the first probe being closer to the read head than the second probe; and
 - 20 the first probe being recessed from the head surface plane and the second probe being coextensive with the head surface plane.
4. A data storage apparatus as claimed in claim 3 wherein the first probe increases in magnetic material volume as it extends toward the head surface.
- 25 5. A data storage apparatus as claimed in claim 1 further comprising:
 - biasing means for applying a constant bias field to the stabilizer.
6. A data storage apparatus as claimed in claim 5 wherein the constant bias field is greater than two (2) times the magnetic coercivity of the soft underlayer.

7. A data storage apparatus as claimed in claim 1 further comprising:
a write head which has first and second pole pieces; and
one of the first and second probes and one of the first and second pole pieces
being a common component.

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8. A data storage apparatus as claimed in claim 7 wherein the stabilizer
includes:

first and second elongated probes and a bridge with the bridge interconnecting the
first and second probes; and

10 the read head being located between the first and second probes.

9. A data storage apparatus as claimed in claim 8 further comprising:
the read head having a head surface which defines a head surface plane;
the first probe being closer to the read head than the second probe; and
15 the first probe being recessed from the head surface plane and the second probe
being coextensive with the head surface plane.

10. A data storage apparatus as claimed in claim 9 wherein the first probe
increases in magnetic material volume as it extends toward the head surface.

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11. A data storage apparatus as claimed in claim 10 further comprising:
biasing means for applying a constant bias field to the stabilizer.

12. A data storage apparatus as claimed in claim 11 wherein the constant bias
25 field is greater than two (2) times the magnetic coercivity of the soft underlayer.

13. A data storage apparatus as claimed in claim 12 wherein the read head
comprises;

30 nonmagnetic first and second read gap layers;
a sensor located between the first and second read gap layers;

ferromagnetic first and second shield layers; and
the first and second read gap layers being located between the first and second
shield layers.

5 **14.** A data storage apparatus as claimed in claim 1 further comprising:
a write head; and
in addition to the read head being located between the first and second probes, the
write head also being located between the first and second probes.

10 **15.** A data storage apparatus as claimed in claim 14 wherein the stabilizer
includes:

first and second elongated probes and a bridge with the bridge interconnecting the
first and second probes; and
the read head being located between the first and second probes.

15 **16.** A data storage apparatus as claimed in claim 15 further comprising:
the read head having a head surface which defines a head surface plane;
the first probe being closer to the read head than the second probe; and
the first probe being recessed from the head surface plane and the second probe
20 being coextensive with the head surface plane.

17. A data storage apparatus as claimed in claim 16 wherein the first probe
increases in magnetic material volume as it extends toward the head surface.

25 **18.** A data storage apparatus as claimed in claim 17 further comprising:
biasing means for applying a constant bias field to the stabilizer.

19. A data storage apparatus as claimed in claim 18 wherein the constant bias
field is greater than two (2) times the magnetic coercivity of the soft underlayer.

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20. A data storage apparatus as claimed in claim 19 wherein the read head comprises;

nonmagnetic first and second read gap layers;

a sensor located between the first and second read gap layers;

5 ferromagnetic first and second shield layers; and

the first and second read gap layers being located between the first and second shield layers.

21. A method of making a data storage apparatus comprising the steps of:

10 forming a read head for reading magnetic data from a recorded portion of a recording layer of a perpendicularly recorded magnetic medium;

forming a stabilizer for magnetically stabilizing a portion of an underlayer of the magnetic medium directly below the recorded portion simultaneously while the read head is reading said magnetic data from the recorded portion; and

15 forming the read head and the stabilizer as separate structures.

22. A method as claimed in claim 21 wherein the method further comprises the steps of:

20 providing the stabilizer with first and second elongated probes and a bridge wherein the bridge interconnects the first and second probes; and

locating the read head between the first and second probes.

23. A method as claimed in claim 22 wherein the method further comprises the steps of:

25 providing the read head having a head surface which defines a head surface plane; locating the first probe closer to the read head than the second probe; and recessing the first probe from the head surface plane and making the second probe coextensive with the head surface plane.

24. A method as claimed in claim 23 wherein the method further comprises the step of:

applying a constant bias field to the stabilizer.

5 25. A method as claimed in claim 24 wherein the constant bias field is formed greater than two (2) times the magnetic coercivity of the soft underlayer.

26. A method as claimed in claim 21 wherein the method further comprises the steps of:

10 providing a write head; and

in addition to locating the read head between the first and second probes, also locating the write head between the first and second probes.

27. A method as claimed in claim 26 wherein the method further comprises 15 the steps of:

providing the stabilizer with first and second elongated probes and a bridge wherein the bridge interconnects the first and second probes; and

locating the read head between the first and second probes.

20 28. A method as claimed in claim 27 wherein the method further comprises the steps of:

providing the read head having a head surface which defines a head surface plane;

locating the first probe closer to the read head than the second probe; and

25 recessing the first probe from the head surface plane and making the second probe coextensive with the head surface plane.

29. A method as claimed in claim 28 wherein the method further comprises the step of:

applying a constant bias field to the stabilizer.

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30. A method as claimed in claim 29 wherein the constant bias field is formed greater than two (2) times the magnetic coercivity of the soft underlayer.

31. A method of suppressing noise while reading from a perpendicular
5 recorded medium comprising the steps of:

employing a read head for reading a recorded portion of a top recording layer; and
simultaneously with said reading, employing a stabilizer, which is separate from
the read head, for introducing a field into a portion of a bottom underlayer directly below
the recorded portion with sufficient strength to stabilize said portion of the bottom
10 underlayer in a single domain state.

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